A NEW SPECIES OF *HALICYCLOPS* (COPEPODA, CYCLOPOIDA) FROM ESTUARIES IN TRANSKEI, SOUTHERN AFRICA

By

T. WOOLDRIDGE

Department of Zoology, University of Port Elizabeth

(With 3 figures and 1 table)

[*MS. accepted 28 April 1977*]

ABSTRACT

A new species of the genus *Halicyclops* Norman, 1903 is described and illustrated from estuaries in Transkei, southern Africa. The species, *Halicyclops pondoensis*, is closely allied to *H. neglectus*, *H. rotundipes* and *H. higoensis*. It is distinguished from these three forms particularly in regard to the fourth and fifth pair of legs. In *H. pondoensis* hair-like structures are present in the proximal part of the seta of the first endopodite segment of leg 4. These hair-like structures are absent in other species. Two spines and three setae are present on leg 5 of the male of *H. pondoensis*. In *H. neglectus*, *H. rotundipes* and *H. higoensis* the male 5th leg bears three spines and two setae. In the present species the second segment of the 5th leg in both the male and female is elongated.

A key to the species recorded from the African continent south of the Tropic of Cancer, and from the islands of Madagascar and Réunion, is given.

CONTENTS

INTRODUCTION

A new species of the cyclopoid copepod genus *Halicyclops* was found in plankton samples collected from estuaries on the east coast of southern Africa. The genus has a world-wide distribution and is recorded from marine, brackish and fresh-water habitats. Although most species are free-living, a number are reported from the interstitial fauna of marine beaches. Species of *Halicyclops* are also found on the body surface or in the tubes of polychaete worms. *Halicyclops caridophilus* inhabits the gill chamber of the mudlobster, *Thalassina anomala*.

The genus is so far known from 47 described forms. The present species is the first member of the genus described from estuaries in southern Africa, although Hill (1966) tentatively recorded *H. pilifer* from the Umlalazi estuary (28°57′S), Zululand. The new species of *Halicyclops* reported here is recorded

Ann S. Afr. Mus. 73(10), 1977: 361–371, 3 figs, 1 table.

from Msikaba estuary (31°19′S) and Mbotyi estuary (31°28′S) on the Pondoland coast, Transkei. Specimens were taken at all seasons from May 1972 to March 1973 in plankton tows collected from just below the water surface in salinities ranging from 1–33‰.

DESCRIPTION OF MATERIAL

Halicyclops pondoensis sp. nov.

Figs 1–3

HOLOTYPE

SAM–A15614 in the South African Museum, Cape Town. Adult female from Mbotyi estuary on the Pondoland coast (31°28′S), collected by T. Wooldridge, 29 November 1972.

PARATYPES

SAM–A15614 in the South African Museum, Cape Town. Numerous adult males and adult females from Mbotyi estuary on the Pondoland coast (31°28′S), collected by T. Wooldridge, 29 November 1972.

Description

Female. Total length 0,61–0,68 mm (mean of five specimens 0,65 mm). Metasome about twice the length of the urosome. Rostrum small, bluntly triangular, curved ventrally and posteriorly, and hence not visible from the dorsal side.

Cephalic segment bluntly rounded anteriorly, wider than long (1,25–1,33 : 1), the greatest width in the posterior region (Fig. 1A). Second thoracic segment longer than third and fourth respectively, which are equal in length. The posterior lateral edges of second and third segments free, angular; those of the fourth segment free but more rounded. Fifth thoracic segment short, its posterior lateral margins bluntly pointed and bearing the fifth pair of legs.

Genital segment (Fig. 2A) with small protrusions on the anterior lateral margin. Length subequal to the width. Urosomal segments posterior to genital segment progressively shorter and narrower, the anal segment with a deep medial incision. Posterior border of the first three segments of urosome denticulate. Anal segment serrated on the posterior ventral border only. A row of fine spinules on anterior dorsal side of the anal segment.

Furcal rami (Fig. 2A) slightly longer than wide and about equal in length to the anal segment. All furcal setae usually found in the genus present, the proximal dorso-lateral seta reaching slightly beyond furca. Dorsal seta about twice the length of the dorso-lateral seta, arising from the inner posterior region. Ornamented basally with minute spinules. Apical setae long and stout, the inner as long or slightly longer than the length of the metasome, the outer less than half as long. Proximal half of shorter and less stout seta spinose on its outer margin only, distal half plumose, ornamented basally on dorsal surface by a row

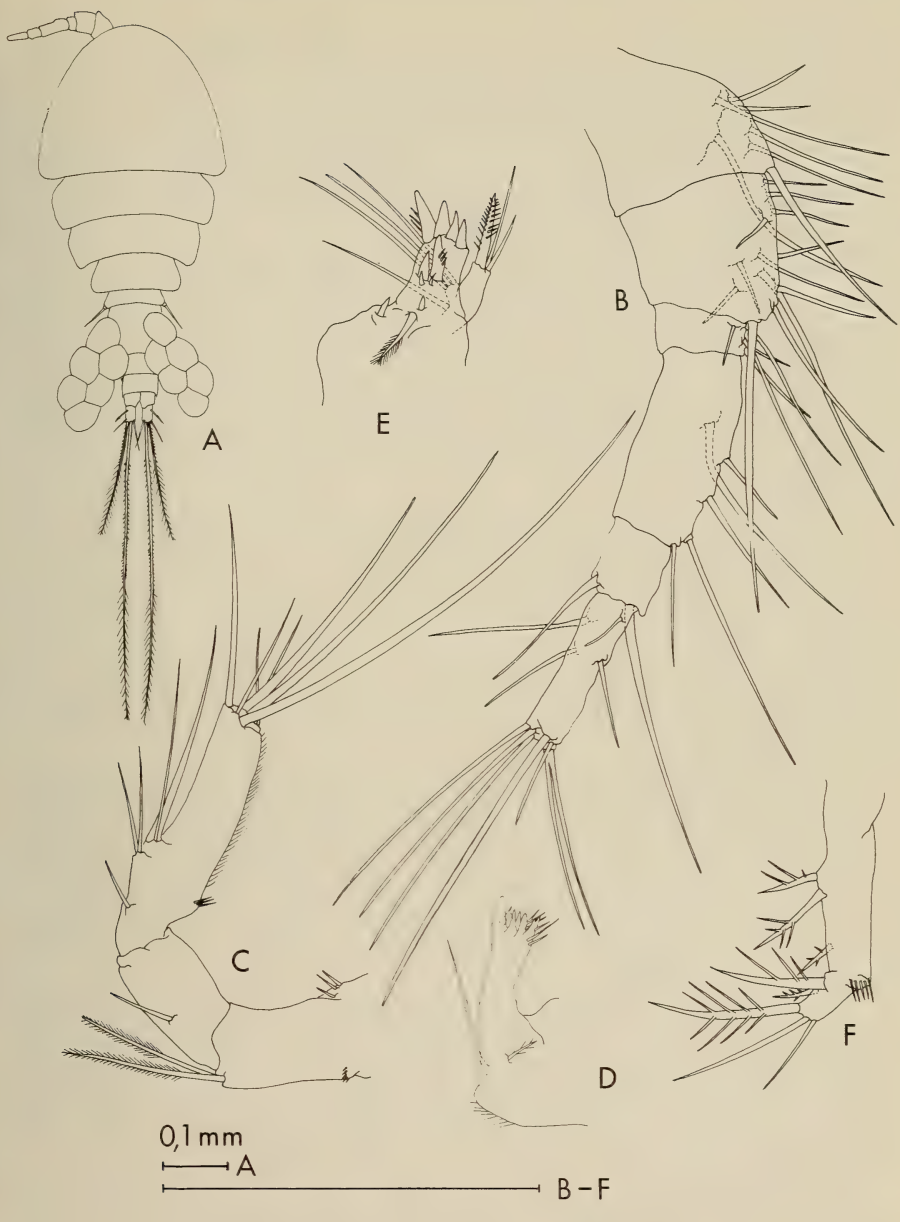

Fig. 1. Female. A. 0,62 mm female. B. Antennule. C. Antenna. D. Mandible. E. Maxilla 1. F. Maxilliped.

of short spinules. Inner apical seta spinose on lateral margins in proximal half, the spines becoming less sparse posteriorly. Terminal half plumose. Innermost furcal seta short, about one-third the length of ramus. Outermost seta non-plumose, about one and a half times length of ramus.

Antennule six segmented (Fig. 1B), almost half as long as cephalic segment. Ultimate and penultimate segment combined slightly longer than anti-penultimate segment. Setation and relative lengths illustrated in Figure 1B. Aesthetask present on distal margin of ultimate segment.

Antenna three segmented (Fig. 1C), with two setae on anterior lateral border of first segment. Inner lateral margin with a number of short spines. Second segment with one seta. Third segment about three and a half times as long as broad, bearing five lateral setae. Two lateral setae, of which one is relatively stout, born on raised portion midway along length of segment. Terminal group consisting of three slender and four stout setae, the longest placed sub-terminally. A row of fine spinules along inner lateral border of ultimate segment.

Mandible slender (Fig. 1D), with seven irregular teeth terminally. Outer basal area with a long and a shorter plumose seta.

Maxilla 1 bilobed (Fig. 1E), with broad basal segment. Inner lobe with four apical teeth, the posterior lateral tooth longer and more robust. Dorsal surface bearing four short and two large robust teeth. A plumose seta on inner, proximal border. Outer lobe or palp with four lateral, non-plumose setae, the three distal teeth borne on a slightly produced lobe. Apex of palp bearing a barber spine and two slender setae.

Maxilla 2 (Fig. 2B), largest of oral appendages. First and second segment bearing two plumose, and a single non-plumose seta respectively. Third segment modified, expanded and produced into two stout serrated claws and a single non-plumose seta Attenuated lacinia between second and third segments, bearing a smooth spine in mid-region, and three more on distal half. Terminal segment slightly wider than long, with two stout, serrated claws, two hair-like setae and a smooth spine.

Maxilliped slender (Fig. 1F), basal segment with three attenuated spines along inner lateral margin. Terminal segment less than half as long as basal, with two attenuated spines on inner lateral margin. More proximal spine robust and long. Distal margin bears a claw-like attenuated spine and two subterminal setae the longer equal in length to the terminal spine and about two and a half times as long as apical segment.

Swimming legs 1–4 biramous (Figs 2C–D, 3A), first basipodite segment bearing seta on inner margin, the second with seta on outer margin. Distal margin of second basipodite segment of first four pairs of legs with fine spinules. Exopodite and endopodite three segmented, the second podomere shorter than the first and third, more pronounced on exopodite. Outer lateral margins of endopodite segments of legs 1–4 with fine, hair-like setae.

First pair of legs (Fig. 2C) smaller than succeeding pairs, the second basi-

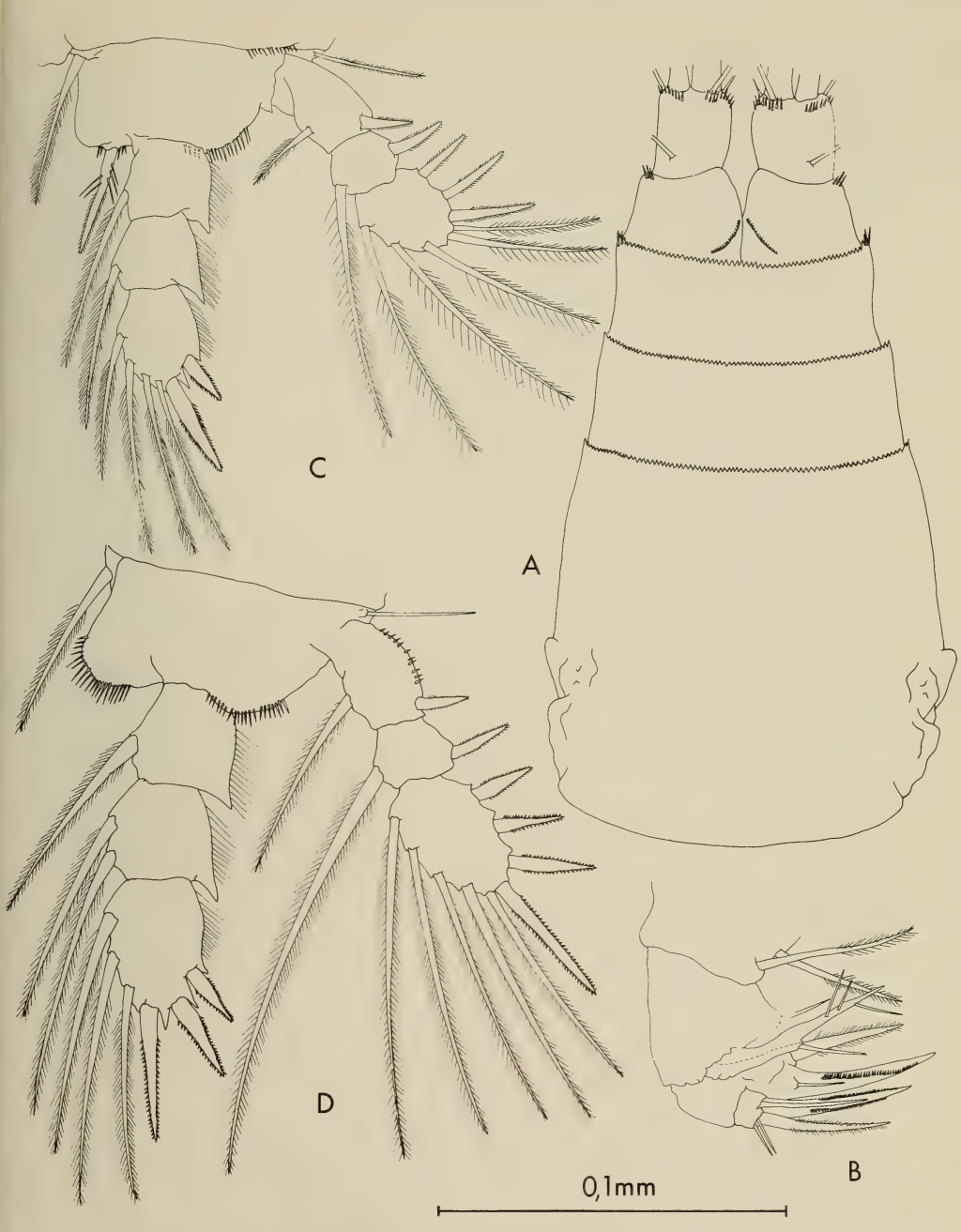

Fig. 2. Female. A. Abdomen. B. Maxilla 2. C. Leg 1. D. Leg 2.

podite segment with a stout, serrated spine on inner distal margin, reaching to about the mid-point of the endopodite. Proximal region of spine bearing a number of smooth setae, the number and relative lengths showing individual variation. First exopodite segment with one serrated spine and one short plumose seta. Second exopodite segment with one serrated spine and one long plumose setae. First and second endopodite segments each with a single plumose seta. Third segment with sharp, spine-like distal corners and bearing two serrate spines and four plumose setae.

Second and third pairs of legs similar, the ornamentation as follows: first and second exopodite segment each with a serrated spine and one plumose seta (Fig. 2D). Apical segment with three lateral spines, one long terminal spine and five plumose setae. Outer lateral border of first exopodite of second leg with fine spinules. These spinules present on first and second exopodite segment of third pair of legs. First endopodite segment with one plumose seta, second segment with two plumose setae and apical segment with three plumose setae, two terminal spines and one lateral spine. Exopodite and endopodite spines all serrated. Terminal segment with sharp distal corners.

Fourth pair of legs similar to preceding two pairs, but showing differences in ornamentation of the terminal segments and in the structure of the seta of first endopodite segment (Fig. 3A). Exopodite three with five plumose setae, two lateral spines and one terminal spine. Outer lateral border with minute spinules. Terminal segment of endopodite with one lateral spine, two terminal spines and two inner plumose setae. Seta of first endopodite segment with about eight long, slender hairs in proximal region.

Leg 5 (Fig. 3B) with first segment fused with thoracic segment, bearing a long, smooth seta on a basal protuberance. Protuberance ornamented with a row of fine spinules. Second segment about one and three-quarters as long as wide. Inner lateral margin straight, with one subterminal, finely serrated spine. Length of this spine distinctly less than length of second segment. Terminal seta long and slender, about twice the length of inner spine. Outer margin with two finely serrated spines, the more proximal always the longest and about equal in length to the second segment. All spines relatively slender. Origin of terminal seta almost equidistant between two subterminal spines. Second segment with a number of rows of fine spinules, their relative positions illustrated in Figure 3B.

Male. General body form similar to female, but smaller in size (Fig. 3C). Total length 0,49–0,53 mm (mean of eight specimens 0,51 mm). Urosome slender, five segmented. Anal segment and caudal furcae as in female.

Antennule of about thirteen segments (Fig. 3D), prehensile. Segments difficult to define. Structure and arrangement of setae illustrated in Figure 3D. Remaining cephalic appendages and legs 1–4 as in female.

Leg 5 first segment and ornamentation similar to female (Fig. 3E). Second segment about twice as long as wide, inner margin straight, with two slender plumose setae in distal half. Setae slightly longer than second segment. Terminal setae distinctly plumose and almost twice as long as second segment. Rounded

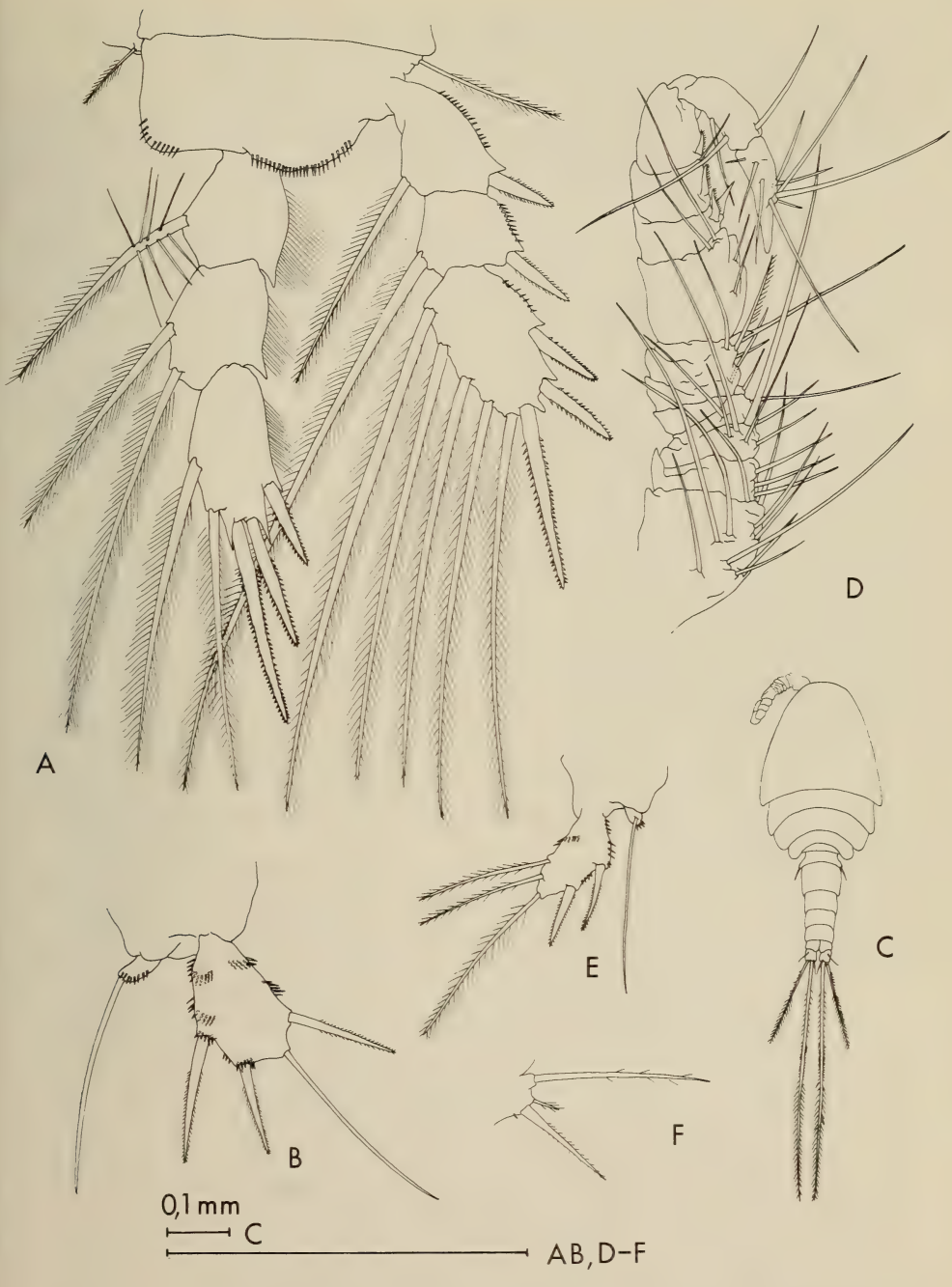

Fig. 3. A–B. Female. A. Leg 4. B. Leg 5. C–F. Male. C. 0,49 mm male. D. Antennule. E. Leg 5. F. Leg 6.

outer lateral margin with two short, finely serrated, slender spines. Length of spines about half the length of lateral setae on the inner border of segment. Margin of segment with a number of fine spinules.

Leg 6 (Fig. 3F) with a plumose outer seta almost equal in length to terminal seta of leg 5, borne on a produced lobe. Inner lobe broad, bearing a sharp serrated spine and a short spine-like seta.

DISCUSSION

The genus *Halicyclops* Norman, 1903 is widely scattered geographically and is known from forty-seven described species. A key to the species by Lindberg (1957) and a paper by Wilson (1958) were valuable aids to workers and did much to emphasize important diagnostic characteristics. At the time of Lindberg's (1957) publication, thirty-three species of the genus had been described. A further ten species were noted by Kiefer (1967). To this list must be added *Halicyclops ryukyuensis* Ito, 1962, *H. latus* Chia-Jui & Ai-Yun, 1964, *H. ambiguus* Kiefer, 1967, and *Halicyclops longispinosus* Monchenko, 1974.

The present species differs from those already described, but shows similarities to *H. neglectus* Kiefer, 1935 (redescription: Kiefer 1936; Candeias 1964); to *H. rotundipes* Kiefer, 1935 (redescription: Kiefer 1936; Plesa 1956; Petkovski 1955 as *H. neglectus rotundipes*); and to *H. higoensis* Ito, 1958. *H. neglectus* and *H. rotundipes* are no doubt closely allied and Wilson (1958) suggests that the two forms may be synonymous.

Halicyclops pondoensis differs from *H. neglectus*, *H. rotundipes* and *H. higoensis* particularly in regard to the fourth and fifth pair of legs. In *H. pondoensis* the seta on the first endopodite segment of the fourth pair of legs in the male and female bears hair-like structures in the proximal region. These hair-like structures are absent in other species.

The inner proximal seta on the third endopodite segment of the fourth pair of legs differs in *H. higoensis*. In *H. pondoensis*, *H. neglectus* and *H. rotundipes* a typical seta is present. *H. higoensis* is distinguished in having this seta in the form of a spine.

Important differences between the species are also found on the fifth pair of legs. In *H. neglectus* and *H. rotundipes* the second segment in both the male and female is rounded. In *H. higoensis* this segment is slightly elongated. In *H. pondoensis* the second segment in the female is about one and three-quarters as long as wide and about twice as long as wide in the male. The armature on this segment in the male is also characteristic. In *H. pondoensis* there are two spines and three setae. In *H. neglectus*, *H. rotundipes* and *H. higoensis* three spines and two setae are present.

The armature of the sixth pair of legs in the male also shows important differences between the species. In *H. neglectus*, *H. rotundipes* and *H. pondoensis* the spine on leg six is relatively long and slender. In *H. higoensis* this spine is stout. Two setae are also present on leg six and in *H. higoensis*, *H. neglectus* and

H. rotundipes the outermost seta is slightly longer than the inner seta. In *H. pondoensis* the inner seta is short and spine-like.

Small differences between the species are also apparent in the form of the genital segment. In *H. neglectus* and *H. rotundipes* the lateral protrusions are well marked, while in *H. pondoensis* and *H. higoensis* these protrusions are small.

The main differences separating these four species are summarized in Table 1.

H. pondoensis is the fourth member of the genus to be described from the continent of Africa south of the Tropic of Cancer. A further four species are known from the islands of Madagascar and Réunion. A key to these eight species with their geographical distribution is given.

TABLE 1

Summary of important differences separating *H. pondoensis* from three closely allied forms.

	Halicyclops neglectus	*Halicyclops rotundipes*	*Halicyclops higoensis*	*Halicyclops pondoensis*
Seta on first endopodite segment of leg four, male and female	Typical seta present	Typical seta present	Typical seta present	Seta with hair-like structures in proximal region
Inner proximal seta on third endopodite segment of leg four, male and female	Typical seta present	Typical seta present	Spine present	Typical seta present
Second segment of fifth pair of legs in male and female	Rounded	Rounded	Slightly longer than round	One and three-quarters as long as wide in female and twice as long as wide in male
Armature of leg five in male	Three spines and two setae present	Three spines and two setae present	Three spines and two setae present	Two spines and three setae present
Armature of leg six in male	Spine long and slender	Spine long and slender	Spine short and stout	Spine long and slender
	Outermost seta slightly longer than inner seta	Outermost seta slightly longer than inner seta	Outermost seta slightly longer than inner seta	Outermost seta much longer than inner seta which is spine-like
Genital segment	Lateral protrusions well marked	Lateral protrusions well marked	Lateral protrusions small	Lateral protrusions small
Total body length:				
Male	390–440 μm	460 μm	460 μm	490–530 μm
Female	600 μm	500–560 μm	520 μm	610–680 μm

KEY TO THE SPECIES OF *HALICYCLOPS* FROM THE CONTINENT OF AFRICA SOUTH OF THE TROPIC OF CANCER AND FROM THE ISLANDS OF MADAGASCAR AND RÉUNION WITH A NOTE ON THEIR DISTRIBUTION

1. Inner seta absent on endopod segment 3 of leg 4 *H. korodiensis* Onabamiro, 1952
   Distribution: Nigeria.
– Inner seta present on endopod segment 3 of leg 4 2
2. Spines along posterior dorsal edge of penultimate abdominal segment longer in the middle region than on the sides 3
– Spines along posterior dorsal edge of penultimate abdominal segment equal in length 6
3. Spine formula on terminal exopod segments of legs 1–4, 2.3.3.3. Furcal rami about as long as broad .. .. *H. pusillus* Kiefer, 1954
   Interstitial, Manoantsetra lagoon, Madagascar.
– Spine formula on terminal exopod segments of legs 1–4, 3.4.4.3. Furcal rami longer than broad 4
4. Chitinous spine present on each side of genital segment.. *H. thermophilus* Kiefer, 1929
   In a limestone cave, Madagascar (Lindberg 1952).
– No chitinous spine present on each side of genital segment 5
5. Furcal rami at least 2 times as long as broad. Spines along the posterior dorsal edge of penultimate abdominal segment extremely long in the middle region, reaching beyond midlength of anal segment .. .. *H. denticulatus* Kiefer, 1960
   Brackish water near Manambato, Madagascar.
– Furcal rami about 1,5 times as long as broad. Spines along the posterior dorsal edge of penultimate abdominal segment slightly longer in the middle region than on the sides, not reaching beyond midlength of anal segment .. *H. reunionis* Kiefer, 1960
   Island of Réunion.
6. Genital segment broader than long .. .. *H. gauldii* Plesa, 1961
   Interstitial: Lighthouse Beach, Accra, Ghana.
– Genital segment about as long as broad 7
7. Genital segment with small lateral protrusions. Furcal rami about as long as broad. Hair-like structures on distal part of seta of 1st endopodite segment of leg 4. Three spines and a single seta on second segment on leg 5 of female. Two spines and three setae present on leg 5 in male .. .. *H. pondoensis* sp. nov.
   Pondoland estuaries, Transkei. Planktonic.
– Genital segment without lateral protrusions, or at most, a weak projection present. Furcal rami about 1,5 times as long as broad. No hair-like structures on seta of 1st endopodite segment of leg 4. Three spines and a single seta on second segment of leg 5 of female. Male undescribed .. .. .. *H. orae eburnensis* Lindberg, 1957
   Ebrie lagoon, Ivory Coast.

ACKNOWLEDGEMENTS

I am indebted to the South African National Council for Oceanographic Research and to the Department of Planning and the Environment who funded this project and to Dr J. R. Grindley under whose directorship this work was initiated. I thank Dr J. P. Furstenberg who critically read drafts of this manuscript.

REFERENCES

Candeias, A. 1964. Contribution to the knowledge of the development of *Halicyclops neglectus* Kiefer. *Revta Biol., Lisb.* **4**: 171–188.

Chia-Jui, S. & Ai-Yun, T. 1964. Descriptions of new species of fresh-water copepods from Kwangtung Province, South China. *Acta Zootaxon. sin.* **1**: 367–396.

HILL, B. J. 1966. A contribution to the ecology of the Umlalazi estuary. *Zool. afr.* **2**: 1–24.
ITO, T. 1958. Groundwater copepods from south-western Japan. *Hydrobiologia* **11**: 1–28.
ITO, T. 1962. Groundwater copepods from the Ryu-Kyu Island. *Jap. J. Zool.* **13**: 275–292.
KIEFER, F. 1929. Neue Ruderfusskrebse von den Sunda-Inseln. (1. Mitteilung über die Copepoden der Sunda-Expedition Rensch-Hebener.) *Zool. Anz.* **84**: 46–49.
KIEFER, F. 1935. Zur Kenntnis der Halicyclopen (Crustacea Copepoda). *Zool. Anz.* **110**: 10–13.
KIEFER, F. 1936. Freilebende Süss- und Salzwassercopepoden von der Inseln Haiti. Mit einer Revision der Gattung *Halicyclops* Norman. *Arch. Hydrobiol.* **30**: 263–317.
KIEFER, F. 1954. Neue Cyclopoida Gnathostoma (Crust. Cop.) aus Madagascar 1. Cyclopiniae und Halicyclopinae. *Zool. Anz.* **153**: 308–313.
KIEFER, F. 1960. Neue Cyclopoida Gnathostoma (Crust. Cop.) von den Inseln Madagascar und Réunion. *Zool. Anz.* **165**: 226–232.
KIEFER, F. 1967. Cyclopiden aus salzhaltigen Binnengewässern Australiens (Copepoda). *Crustaceana* **12**: 292–302.
LINDBERG, K. 1952. Cyclopides (Crustacés copepodes) de Madagascar Troisième note. *Mém. Inst. scient. Madagascar* **7A**: 53–67.
LINDBERG, K. 1957. Cyclopides (Crustacés copépodes) de la Côte d'Ivoire. *Bull. Inst. fr. Afr. noire* (Sér. A) **19**: 134–179.
MONCHENKO, V. I. 1974. A new *Halicyclops* (Crustacea, Copepoda) species from the Dnieper–Bug estuary. *Vestn. zool.* **3**: 47–52. (In Russian with Russian and English summaries.)
NORMAN, A. M. 1903. New generic names for some Entomostraca and Cirripedia. *Ann. Mag. nat. Hist.* (Series 7) **11**: 367–369.
ONABAMIRO, S. D. 1952. Four new species of *Cyclops* sensu lat. (Crustacea: Copepoda) from Nigeria. *Proc. zool. Soc. Lond.* **122**: 253–266.
PETROVSKI, T. K. 1955. Beitrag. zur Kenntnis der Copepoden. *Acta Mus. maced. Sci. nat.* **3**: 71–104.
PLESA, C. 1956. Quelques remarques sur les Halicyclopes (Cruaracés copépodes) des eaux roumaines. *Folia balc.* **1**: 25–28.
PLESA, C. 1961. New Cyclopoides (Crustacea, Copepoda) of the Interstitial Fauna from the Beaches of Ghana. *Jl W. Afr. Sci. Ass.* **7**: 1–13.
WILSON, M. S. 1958. The Copepod genus *Halicyclops* in North America with description of a new species from Lake Pontchartrain, Louisiana, and the Texas coast. *Tulane Stud. Zool.* **6**: 176–189.